Effects of Pre-College Agricultural Background on Student Performance in College Introductory Agricultural Courses

B. Bruce Greene[1] and B. L. Byler[2]
Tennessee Technological University
School of Agriculture
Cookeville, TN 38505

Abstract

Relationships between agricultural background and academic performance in college-level introductory agricultural courses were investigated with 268 students enrolled in the School of Agriculture at Tennessee Technological University. Students were asked to complete a questionnaire that indicated whether they had been reared on a farm and had taken agricultural courses in high school. Results indicated that there was limited overall effect of farm background or high school agricultural course background on grades made by students in introductory Animal Science, Plant Science, Agricultural Engineering Technology, Agribusiness Management, or Soil Science college courses. Comparing effects of pre-college agricultural background at each grade level within each introductory course showed small and inconsistent differences. In general, the conclusion was made that some pre-college agricultural background may increase the probability of students making 'B's' or 'C's', depending on the level of difficulty of the individual course. There did not appear to be a strong relationship between background and students that made 'A's', and there appeared to be an inconsistent and limited relationship between background and students making 'D's' and 'F's". English and composite ACT scores were slightly higher for students that did not have a farm background.

Introduction

Enrollment numbers and experiential background profiles of students pursuing degrees in colleges of agriculture have changed over the past 30 years. These changes have most likely been greatly affected by the increase in technological advances in agricultural production and the decrease in the proportion of the population involved in careers directly related to agriculture. Dyer et al. (1999) reported decreases in enrollment in high school and college level agricultural courses in the 1970's and 80's and subsequent slight increases in the 1990's. They also noted increasing numbers of freshmen from urban or non-farm backgrounds enrolling in college agricultural programs as indicated by Scofield (1995). Much discussion concerning changes in teaching methods and subject material to meet these challenges has taken place among college agriculture faculty members.

Many studies have been conducted to determine factors that affect academic performance of students who enroll in colleges of agriculture. Identification and evaluation of these factors can aid faculty members in developing teaching methodology that increases the chance of acceptable academic performance and perhaps student retention. Results of most studies have shown that high school core grade point averages and ACT scores were the best indicators of future college academic performance (Garton et al., 2001; 2002). Other variables, such as student gender and learning style, have shown little or no effect on academic performance of freshmen agriculture students (Bridges and Casavant, 2000; Garton et al., 2002).

Previous experiences in similar fields have been found to affect academic performance and retention in college agricultural and non-agricultural programs to varying degrees. Cole and Fanno (1999) found that students with strong backgrounds in FFA and 4-H left the Oregon State University agricultural program at as slower rate as those with no backgrounds. Bridges and Casavant (2002) found that students who had taken economics courses in high school were better able to grasp college introductory economics material.

Wildman and Torres (2002) and Donnermeyer and Kreps (1994) found that the most influential factor related to students' choice of a major in agriculture was prior agricultural experience.

Dyer et al. (1999) suggested that students without previous agricultural experiences presented new challenges to agricultural faculty in that more information about agriculture will be required. Some faculty members have expressed concern that the lack of agricultural experience among students has made teaching introductory class material more difficult, and perhaps less effective, since a lower percentage of the students were 'prepared' to learn the material.

The present study was initiated to investigate the possible effects of previous agricultural experience on

[1]Associate professor, Animal Science
[2]Professor, Agricultural Education

subsequent academic performance of students pursuing the Bachelor's degree in Agriculture at Tennessee Technological University. The primary objective was to determine whether a background in agriculture, as measured by farm or non-farm background and previous experience or non-experience in high school agricultural courses, affected academic performance of students enrolled in the introductory core agriculture courses required of all majors in the School of Agriculture. A secondary objective was to determine whether ACT scores might influence academic performance in these courses and thus be partially responsible for any differences that might be found between agricultural background and academic performance.

Materials and Methods

Survey data were collected from 268 incoming freshmen and transfer students as they pre-registered for their first semester in the School of Agriculture at Tennessee Technological University from 1996 through 2001. Students were asked a number of questions to help the faculty direct the program to fit the needs of the greatest number of students and to help in establishing recruiting goals. Questions included college classification, marital status, presence or absence of agricultural background and experience, general high school background, extracurricular activities, and decision to matriculate in the School of Agriculture at Tennessee Technological University.

The two major research questions that guided this study were

1. Are you or your parents presently living on a farm or ranch?
2. Did you take any agriculture courses in high school?

Question 1 had more than two possible answers on the questionnaire, giving students the opportunity to select whether the farm on which they lived was their parents', their own, or rented, but selections of all respondents were reduced to a 'Yes' or 'No' category for the purpose of this study. Respondents were also given the opportunity to identify the number of high school semesters they had taken agriculture courses, but the responses were reduced to whether students had or had not completed any high school agricultural courses for the purpose of the present study.

The School of Agriculture at Tennessee Technological University provides a Bachelor of Science degree in Agriculture with various concentrations in eight disciplines (Agribusiness Management, Agricultural Education,

Agricultural Engineering Technology, Agronomy and Soils, Animal Science, Environmental Agriscience, Horticulture, and Nursery and Landscape Management). A core of introductory courses from Agribusiness Management, Agricultural Engineering Technology, Plant Science, Animal Science, and Soil Science is required of every major for graduation in any concentration. Three upper division courses from any three concentrations other than the major concentration are required for completion of the agriculture core requirement and may differ among students depending on individual interests and goals. Therefore, the introductory core courses were chosen for analysis in the present study.

The data set included introductory agriculture course grades of students who had completed the survey. Not all students had taken every introductory course offered in the School of Agriculture so numbers of observations differed among disciplines. Numbers of students having course grades and answers to the survey questionnaire are shown in Table 1. All Plant Science, Agricultural Engineering Technology, Agribusiness Management, and Soil Science introductory courses were taught, and grades administered, by one professor each. Two professors taught the Animal Science introductory course with each professor having taught approximately half of the students involved in the study.

Letter grades ('A', 'B', 'C', 'D', or 'F') were used as the measure of academic performance in this study and so academic performance was considered to be a categorical variable. Effects of previous agricultural experiences on overall proportions of students receiving the various letter grades in each introductory core course were tested with the Chi-Square statistic. Subsequent Chi-Square tests were then conducted by letter grade within each introductory core course to evaluate the effects of agricultural experiences at each grade. Non-proportionality of academic performance based on chosen concentration of students enrolled in the School of Agriculture was tested with the Chi-Square statistic to investigate any interdependency between chosen concentration and agricultural background in their possible effect on student performance in the various introductory core courses. Possible differences in ACT

Table 1. Numbers of students from farm or non-farm backgrounds and taking or not taking agricultural courses in high school.***[z]

		HIGH SCHOOL AGRICULTURAL COURSES		
		YES	NO	TOTALS
FARM BACKGROUND	YES	98	38	136
	NO	59	73	132
	TOTALS	157	111	268

[z] ***P= 0.001 of disproportionate distribution of numbers of observations in FARM BACKGROUND by HIGH SCHOOL AGRICULTURAL COURSE EXPERIENCE using the Chi-Square statistic.

scores based on students' agricultural background were tested by analysis of variance to identify whether there was a difference in the academic abilities of students between the two groups.

Results and Discussion

Survey data were available for 268 students (Table 1). Numbers of students from farm or non-farm backgrounds were well balanced, with 136 and 132 students representing each group, respectively. Forty-six more students had taken at least one agriculture course in high school than those who had taken no agriculture courses. Number of students from farm backgrounds that took high school courses, however, was not evenly distributed (P < .001). Of the 136 students from a farm background, 72% had enrolled in high school agricultural courses, while only 44.7% of students who were not from a farm background had enrolled.

Approximately 50% of the 268 students who completed the questionnaire had taken the introductory Animal Science and Plant Science courses (Table 2). Less than 43%, however, had taken the Introductory Agricultural Engineering Technology, Agribusiness Management, or Soil Science courses. The Animal Science and Plant Science courses were

Table 2. Numbers of students completing the questionnaire taking each of the respective introductory courses.

COURSE	NUMBERS OF STUDENTS
Animal Science	124
Plant Science	134
Agricultural Engineering Technology	70
Agricultural Business	95
Soil Science	66

freshmen level course while the other three were sophomore level courses and were not taken by some students until their sophomore or junior year. Students often completed many of the lower- and upper-division courses that met the requirements of their chosen concentration before enrolling in the required core of introductory courses from other concentrations.

Data were further analyzed by grade level and the Chi-Square Statistic was used to examine differences by each grade. Data shown in Table 3 represent the percent of students with or without farm backgrounds or high school agricultural courses receiving each grade in all the introductory courses. It should be noted that analyses of the data by grade level required some of the tests to be made on small numbers of observations and the Chi Square test may not be valid. Analysis of the data by grade level, however, gave the opportunity to determine whether a larger proportion of the students may have made low or high grades depending on farm background or high school agricultural courses.

Effect of agricultural background on student performance in the Animal Science, Plant Science,

and Soil Science introductory courses followed a similar pattern. A larger proportion (P < .10) of students from farm backgrounds made 'A's in the Animal Science introductory course and a larger proportion (P < .05) of the students that had taken high school agricultural courses made 'B's (Table 3). There were no differences in the proportions in either preparation category in the other grade levels for Animal Science. 'A' and 'B' grades represented 50% or more of the total number of students that took the Animal Science course and the 'B' grade represented at least 30% of the students for the farm background and the high school agricultural courses categories. In light of this large proportion of the total number of students, it may be reasonable to assume that possession of some agricultural background had a limited positive effect on the higher Animal Science introductory course grades. Results were similar for the Plant Science introductory course with an advantage (P < .01) for the students with a farm background in the 'B' grade (P < .01) and for students having had high school agricultural courses in the 'B' and 'C' grades (P < .10). An even higher proportion, approximately 59%, of the total number of students taking the Plant Science introductory course made 'A's and 'B's than those taking the Animal Science introductory course, and there appeared to be some advantage of an agricultural background for students making the higher grades.

Results of the effect of agricultural background on student grade performance followed a similar pattern for the Agricultural Engineering Technology and Agribusiness Management courses but a somewhat different pattern than found for the Animal Science, Plant Science, and Soil Science courses. The primary difference in the pattern appeared to be that any effect of agricultural background was found at the 'B' and 'C' grade levels rather than the 'A' and 'B' grade levels. The positive effect of agricultural background was lowered by approximately one grade level. Farm background and high school agricultural courses had a positive effect on proportion of 'B' grades in the Agricultural Engineering Technology course (P < .10) and the Agribusiness Management course (P < .10 and P < .05 for the presence or absence of farm background and high school agricultural courses, respectively). Farm background had a positive effect (P < .10 and P < .05, respectively) on 'C' grades in the Agricultural Engineering Technology and Agribusiness Management courses.

A smaller proportion of the total students made 'A's and 'B's in the Agricultural Engineering Technology and Agribusiness Management introductory courses (47.22% and 27.09% for Agricultural Engineering Technology and Agribusiness Management courses, respectively, in the farm

Table 3. Percentage grade distributions of students with farm or non-farm backgrounds and with or without high school agricultural course backgrounds.

GRADE LEVEL	FARM BACKGROUND		HIGH SCHOOL AGRICULTURE COURSES	
	YES	NO	YES	NO
	Animal Science n = 124			
A	17.46τ^z	8.73	15.20NS	10.40
B	15.87NS	14.29	20.80*	9.60
C	13.49NS	13.49	16.00NS	11.20
D	5.56NS	5.56	5.60NS	5.60
F	1.59NS	3.97	1.60NS	4.00
	Plant Science n =134			
A	12.41NS	6.57	11.11NS	7.41
B	27.01**	13.14	25.93τ	14.81
C	13.14NS	16.79	19.26τ	10.37
D	3.65NS	4.38	5.19NS	2.96
F	1.46NS	1.46	0.74NS	2.22
	Agricultural Engineering Technology n =70			
A	9.72NS	5.56	9.86NS	5.63
B	22.22τ	9.72	21.13τ	9.86
C	13.89τ	5.56	12.68NS	7.04
D	13.89NS	11.11	18.31τ	7.04
F	4.17NS	4.17	5.63NS	2.82
	Agribusiness Management n = 95			
A	3.13NS	3.13	2.11NS	3.16
B	14.58τ	6.25	15.79*	5.26
C	27.08*	12.50	20.00NS	20.00
D	16.67τ	7.29	15.79NS	8.42
F	2.08τ	7.29	5.26NS	4.21
	Soil Science n = 66			
A	16.42NS	10.45	16.67NS	10.61
B	23.88τ	10.45	24.24*	9.09
C	16.42NS	11.94	13.64NS	5.15
D	2.99NS	4.48	4.55NS	3.03
F	1.49NS	1.49	3.03	0.00

[z]NS, τ, *, and ** Differences in percentages of "Yes" and "No" responses in each of the two categories (Farm and High School Agricultural Course Backgrounds) are not significant (P > 0.10) or significant at different P= 0.10, P=0.05, and P=0.01, respectively, with the Chi Square statistic.

among the low grades in Agricultural Engineering Technology and Agribusiness Management. Interestingly, a larger proportion (P < .10) of students making 'D's' in the Agricultural Engineering Technology course had taken high school agricultural courses, and in the Agribusiness Management course had a farm background. If students with agricultural backgrounds had some advantage in making the higher grades, it seems that a smaller proportion of them should have made lower grades. The proportion of students making an 'F' in the Agribusiness Management course did follow that pattern with fewer (P < .10) students with farm backgrounds making an 'F'.

An analysis of variance was conducted with ACT scores of the students to determine whether academic abilities were different between students from farm or non-farm backgrounds, which could bias any possible effects of agricultural background on grade distributions in the respective introductory courses (Table 4). No differences (P > .10) were found among Math, Reading, and Science ACT scores of students regardless of whether or not they were from a farm background. English and Composite ACT scores, however, were greater (P < .05) for students who were not from a farm background. Though small in magnitude (1.11 points difference in Composite ACT scores between the two groups), the statistical confounding of academic ability with farm background in this sample of students could have masked some of the effect of farm

background category, Table 3). It could not be determined from this data whether the lower grades were caused by the difficulty of the course or the difficulty of the material. The difference may have been due to the technological and economic nature of the material in the Agricultural Engineering Technology and Agribusiness Management courses, respectively, in contrast to the basic science nature of the Animal Science, Plant Science, and Soil Science courses. No assessment of differences in difficulty of the introductory courses could be made since one faculty member taught all courses within each discipline except the Animal Science Course.

Unlike the Animal Science, Plant Science, and Soil Science introductory courses, there were differences in grade distributions

Table 4. Mean distribution of mean ACT scores by farm background[z].

ACT CATEGORY	ACT SCORES		
	FARM BACKGROUND		OVERALL
	YES	NO	AVERAGE
English	20.90	22.27*[y]	21.53
Math	20.87	21.65NS	21.23
Reading	22.06	23.01NS	22.50
Science	21.91	22.47NS	22.17
Composite	21.05	22.16*	21.56

[z] Data available on 221 students
[y] NS, *Differences in percentages of "Yes" and "No" responses are not significant (P > 0.10) or significant at P=0.05, respectively, with the Chi Square statistic.

background on grades received in the introductory agricultural courses. It should be noted that although not different (P > .10), mean ACT scores for Math, Reading, and Science tended to be higher for students from a non-farm background and may have been found different if a larger number of observations had been available.

Summary

Relationships between agricultural background and academic performance in college-level introductory agricultural courses were investigated with 268 students enrolled in the School of Agriculture at Tennessee Technological University. Students were asked to complete a questionnaire that indicated whether they had been reared on a farm and had taken agricultural courses in high school. Results indicated that there was limited overall effect of farm background or high school agricultural course background on grades made by students in introductory Animal Science, Plant Science, Agricultural Engineering Technology, Agribusiness Management, or Soil Science college courses. Comparing effects of pre-college agricultural background at each grade level within each introductory course showed small and inconsistent differences. In general, the conclusion was made that some pre-college agricultural background may increase the probability of students making 'B's' or 'C's', depending on the level of difficulty of the individual course. There did not appear to be a strong relationship between background and students that made 'A's', and there appeared to be an inconsistent and limited relationship between background and students making 'D's' and 'F's". English and composite ACT scores were slightly higher for students that did not have a farm background.

Literature Cited

Bridges, D. E. and K. L. Casavant. 2000. An initial evaluation of factors affecting students' pre-paredness for economic learning. NACTA Jour. 44(1):35-39.

Bridges, D. E. and K. L. Casavant. 2002. What is the influence of gender, high school economics and other factors on the learning of economics? NACTA Jour. 46(3):10-15.

Cole, L. and W. Fanno. 1999. Survey of early leavers: Implications for recruitment and retention. NACTA Jour. (43)1:53-56.

Donnermeyer, J. F. and G. M. Kreps. 1994. Assessing college of agriculture freshmen. NACTA Jour. 38(1):45-48.

Dyer, J. E., L. M. Breja, and R. J. Andreasen. 1999. Attitudes of college of agriculture freshmen toward agriculture. Jour. Of Agr.Education. 40(2):1999.

Garton, B. L., J. E. Dyer, and B. O. King. 2001. Factors associated with the academic performance and retention of college agriculture students. NACTA Jour. 45(1):27.

Garton, B. L., A. L. Ball, and J. E. Dyer. 2002. The academic performance and retention of college agriculture students. Jour of Agr. Education. 43(1):46-56.

Schofield, G. G. (1995, March). College of agriculture new student. Paper presented at the Central Region 49th Annu. Research Conference in Agr. Education, St. Louis, MO. (As reported in Dyer et al., 1999).

Wildman, M. L. and R. M. Torres. 2002. Factors influencing choice of major in agriculture. NACTA Jour. (46)3:4-9.